to heat a mantle of refractory material up to incandescence, and for this purpose the 15-candle gas will do as well as the 16.

One argument which has been raised against the lowering of the standard is that if a 16-candle gas is reduced to 15 candles during distribution, a 15-candle gas will be lowered to 14. This I think is a mistake. An enriched gas is lowered in illuminating value because certain vapours are condensed from it; but it will be found that with an unenriched gas, made at a high temperature, this action is decreased to a minimum, on account of the small proportion of vapours present.

One of the most important experiments ever tried on a large scale has been made this year, the London County Council having given permission to the South Metropolitan Company to supply unenriched gas to South London for the space of a fortnight, in order to practically ascertain the result during distribution and the loss of light to the consumer.

At the testing stations the gas for the fortnight showed the average value of about 15 candles, ranging from 14 to 16 according to the coal used at the various works, whilst tests made with portable photometers on the consumers' premises gave identical results, before, during, and after this period, clearly showing that the whole value of the enrichment consisted in satisfying the legal requirements, whilst the consumer gained absolutely nothing but the privilege of paying for it.

It is to the interest of the gas consumer and gas company alike that the price of gas should be reduced to the lowest possible figure, and the possibility of reduction in price is entirely dependent upon the discarding of the costly enrichment.

Under the present legal conditions the companies gain nothing by supplying a gas a candle better than the standard, and if they fall a candle below have to pay the absurd fine of 40*s.*, a state of things which if the London companies did not show the greatest anxiety to fulfil all their obligations might lead to a considerable reduction in the value of the gas distributed, as to pay a daily fine and to send out gas of a value of 15·1 candles would save the companies many thousands a year.

This is all manifestly wrong, and if the consumers are to get the full benefit of coal-gas, and if coal-gas is to take its proper place as a fuel as well as an illuminant, its sale must be placed on a sound commercial basis. Enrichment should be entirely given up, and the gas that can be made direct from the coal supplied to the consumer.

A minimum of illuminating value should be fixed for each town based upon the coal used, and any fall below this should be visited by a fine of £50 for the first half-candle, and an increment of £100 for each half-candle below that, whilst the price charged for the gas should be governed by its illuminating value for the quarter as averaged from the testing station returns, a low initial price, say 2*s.* 2*d* per thousand, being charged for 14-candle gas, and 1½*d.* a candle for each candle above it, with a maximum price of 2*s.* 5*d.* If some such scheme as this could be adopted, not only would the consumer obtain the full value for his money, but the gas companies would reap the benefit of an enormously increased consumption for fuel purposes, and the atmosphere of our big cities would gain in proportion.

VIVIAN B. LEWES.

NOTES.

THE Council of the Society of Arts have, with the approval and sanction of the President, H.R.H. the Prince of Wales, awarded the Albert Medal to Sir Joseph Lister, Bart., F.R.S., "for the discovery and establishment of the antiseptic method of treating wounds and injuries, by which not only has the art of surgery been greatly promoted and human life saved in all parts of the world, but extensive industries have been created for the supply of materials required for carrying the treatment into effect."

WE are requested to state that before long a memoir of the late Dr. James Croll, F.R.S., will be ready for publication. Persons having letters from Dr. Croll, or information likely to be of interest, are requested to forward such to J. C. Blackwell, 10, Royal Terrace, Edinburgh. The letters will be returned when their contents have been noted.

A PASTEUR Institute was opened at Tunis on Tuesday by Dr. Loir, a nephew of M. Pasteur.

THE death is announced from Paris of M. Ed. Lefèvre, known for his work in entomology and botany.

PROF. CANNIZZARO has been elected a correspondent of the Paris Academy of Sciences, in the place of the late M. de Marignac.

WE learn from *La Nature* that a department of agricultural entomology has recently been formed at the Institut National Agronomique, and placed under the direction of Prof. Brocchi The work of the department will be to identify insects sent for that purpose by agriculturists, and to point out the means of destroying insect pests or diminishing their ravages.

THE *Cape Times* says that among the latest accessions to the South African Museum are an old imperfect skull and other bones of a white rhinoceros, presented by Mr. W. G. Schmidt. These remains of the now all but extinct "white" or Burchell's rhinoceros were found at a depth of about 8 feet, in black turfy soil, at about twelve miles from the Vaal River.

A COMPLETE statement has been issued of the different sections of the Mining and Metallurgical Exhibition to be opened at Santiago in September next. The classification is as follows:—(1) Motive Power; (2) Electricity; (3) Mining Machinery; (4) Mechanical Preparation of Minerals; (5) Metallurgy; (6) Chemical Industries; (7) Statistics and Plans; (8) Mining and Metallurgical Products.

THE Paris correspondent of the *Times* reports that, at the first meeting of the 1900 Exhibition Commission, the following scheme of classification was read:—The first group of exhibits is entitled "Education," and contains six classes. Group II. comprises "Works of Art," containing paintings, drawings, engraving, lithography, sculpture, the cutting of precious stones, and architecture. Group III. is called "Instruments and General Processes of Literature, Sciences and Arts," including typography, photography, binding, newspapers, maps, instruments of precision, coins and medals, medicine and surgery, musical instruments, and the theatrical art. The IVth Group is "The *Matériel* and General Processes of Mechanics," including steam engines, motors, divers apparatus of general mechanics, and implements. The Vth Group deals with electricity, including the production and mechanical application of electricity, electro-chemistry, electric lighting, telegraph, and telephone. Then come locomotion, agriculture, horticulture, forestry, alimentation, mines, furniture, textiles, chemicals, social economy, and military weapons.

IT is reported by the *British Medical Journal* that a committee of the Calcutta municipality have resolved to recommend that a sum of money be voted for two years in order to test thoroughly M. Haffkine's system of cholera inoculation. This method, worked out by M. Haffkine in the Pasteur Institute in Paris, and applied extensively in India by the investigator himself, was recently put to the test of actual experience near Calcutta. Dr. Simpson, the health officer, took special steps to make the inoculations in the neighbourhood of Calcutta serve as tests, as severely scientific as possible, of the efficacy of the method in man. Of the 200 inhabitants of a native hamlet, 116 were inoculated with the protective vaccine. Not long afterwards, an outbreak of the disease occurred in the hamlet; ten persons were affected, none of whom had been inoculated, and seven died, whereas all those who had been inoculated remained free. If the results of future experiments are favourable, a permanent department will probably be established to carry on the inoculations.

THE Hong Kong correspondent of the *British Medical Journal* gives the following particulars with regard to the epidemic noted in our last issue:—"The plague commenced here on May 5; it presents all the symptoms of the true bubonic pest which devastated Europe in the Middle Ages, and produced the terrible ravages described by Defoe during the great plague in London. This bubonic pest, although extinct in Europe, has never ceased to prevail in China from time to time, and has also spread from there to Persia and Asiatic Russia. The present outbreak is characterised by intense symptoms corresponding to those of typhus, and by the bubonic boils characteristic of the disease. The deaths up to to-day have amounted to 1708, but I am glad to say that the Europeans here are unaffected except in the case of ten of the military employed by the authorities in carrying out disinfecting work in the native quarter where the plague is located; one of them has unhappily died." It is pointed out by our contemporary that this bubonic pest is extremely contagious from person to person, and though aërial infection is not unknown in connection with it, it is so probably only to a slight extent. Like typhus, the plague is mainly diffused by personal contact, and its diffusion is one of the results of overcrowding and dirt.

The U.S. National Academy of Sciences is in a quandary. According to the *American Naturalist*, it has been in a state of paralysis for two years as regards the election of members, owing to the impossibility of concentrating a sufficient number of votes on any one candidate to elect him. At present fifty-eight members are devoted to the physical sciences, and thirty-one represent the natural sciences. Members of the latter class desire to destroy this disproportion, but they cannot procure enough votes to elect an additional member on their side, and the result is a deadlock. It has been proposed by a committee that the Academy be divided into classes, each having a fixed membership, such as exists, for instance, in the Paris Academy of Sciences. Three of these classes were to embrace the physical sciences; two, natural science; and one, the sciences that could not be well classified under either of those heads. This, however, has been objected to, and Prof. E. D. Cope has submitted the following division to the consideration of the committee. Class I. (35 members).—Physical Science (Sciences of Energy); to include Physics, Astronomy, Chemistry, Physiology, and Dynamical and Chemical Geology. Class II. (35 members).—Natural Science (Sciences of Morphology); Structural Geology, Mineralogy (apart from Chemistry), Biology (including Embryology and Palæontology). Class III. (15 members).—Anthropological Science (Sciences treating of phenomena determined by psychic conditions); Antropology, Statistics, Philology, Psychology. Class IV. (15 members).—Applied Science. (Applications in the Arts of any of the Sciences previously enumerated), including Hygiene, Engineering, &c.

SUESS famous work, "Das Antlitz der Erde" (the Face of the Earth), is to be translated into French by M. de Margérie. Abroad, the book is almost as well known to the general public as to geologists, but there seems to be no immediate prospect of an English translation.

WE are reminded of what we lose in this respect by a current article in the German "Weekly Magazine of Science" (*Naturw. Wochenschrift*, May 27 and June 3), on "the Flood and the Ice Age Question." The writer, Richard Hennig, discusses the views so amply stated by Suess in the aforesaid work, also those of Neumayr in the "Erdgeschichte" (History of the Earth). Suess and Neumayr may be said to have proved that the Mosaic account of the flood was copied, with but little alteration, from the original Assyrian version, and that the actual events took place in the plains of the Euphrates and Tigris, and not on the banks of the Jordan. Suess suggested a comparison with the occasional calamities caused in the lower parts of the rivers of India when a cyclonic storm whirls the sea inland, and the rivers overflow wide reaches of town and country. In Suess' opinion the Mosaic flood was of local nature:—"The traditions of other peoples do not in the least justify the assertion that the flood extended beyond the lower course of the Euphrates." Science went with Suess, and the true tale of the flood, while it remained picturesque, lost its magnificence.

NOW, however, Hennig brings forward persuasive arguments in favour of the independent origin of the flood Saga found among so many peoples. He associates it with some of the striking facts which indicate a general increase of rainfall and lowering of the temperature over the whole earth during the Quaternary period—*e.g.*, the presence of enormous lakes in the west of North America, whose water-level rose 1000 feet above the present Salt Lake of Utah, the Ice age and glaciation in North America and in Northern and Central Europe (without which geology would have lost a pet hobby), the floods which accompanied the retreat of the glaciers, the moist climate of Siberia, and the fertility and forest-growth in the now arid Sahara. Hennig concludes that the flood was contemporaneous with the Ice age, and was produced by the unknown causes which then lowered the temperature of the globe. The period was a prolonged one, during which the countries in milder latitudes were converted into swamp and sea, or underwent higher floods of local character under special meteorological conditions. Isolated lands remained free from inundation, Egypt for example, owing to their distance from any region of ice and dry climatic conditions.

THE German Saga tells how "the floods of the north came far from their home and were turned into ice, and the ice stood still, and the mist which hung over it froze . . . . till the hot sun-glow from the south met the hoar, and the frost fell in drops. The sun was strong and his heat gave life to the drops, so that a great frost-giant in the form of a man arose—Ymir of the Hrimthursen. But Börs killed the giant Ymir, and when he fell there ran so much blood from his wounds that the race of the Hrimthursen was drowned, all except him they called Bergelmir. In a boat he saved himself and his wife, and from them sprung the new race of Hrimthursen." The German Saga is scarcely less dramatic than the Eastern. After reading it we feel willing to believe that the Germanic Ossian was *bonâ fide*.

IN the *Programm des Gymnasium Ernestinum* (Gotha: 1894), Dr. A. Schmidt has published an essay on the employment of a trigonometrical series in meteorology, which will be very useful to students of the mathematical branches of that science. It is divided into four sections, the first two of which are devoted to the history of the subject, from their earliest use by Euler, in 1748. Their first application to meteorology is attributed to T. Mayer, whose investigations were published after his death, by Lichtenberg, in 1775, although the principal merit for their employment in meteorology is undoubtedly due to Bessel, who explained their use in a treatise published in 1814. The last two sections deal with the means of deducing the harmonic constants from the usual formulæ, and the need of further investigations by this method. The *Programm* will probably not be generally accessible, but a careful summary of it, by Dr. Grossmann, will be found in the *Meteorologische Zeitschrift* for May of this year.

The results of meteorological observations lose much of their interest when published four years late. Such is the report of the meteorological service of the Dominion of Canada for 1889, a copy of which has just reached us. We note in glancing through the volume that meteorological instruments are supplied to the experimental farms established in different provinces of the Dominion. There were 1126 warnings of approaching storms made during the year, 82·2 per cent. of which were verified. The railway companies in Canada give assistance in many ways to the meteorological service. One of these is by permitting trains to carry discs showing the weather forecasts for the districts through which they travel. A few weeks ago we noted that our Board of Agriculture intended to distribute in rural districts during harvest time, weather forecasts prepared at the Meteorological Office. It may be worth consideration whether such a system could not be usefully extended by displaying the predictions on trains running through agricultural districts.

The earthquake in Baluchistan, described in Nature of August 10, 1893, was also felt in South Russia and in Germany, and a comparison of the records at Nikolaiev and Strassburg is given by Herr E. von Rebeur-Paschwitz in the *Astronomische Nachrichten*, No. 3234. The epicentre of the earthquake was a spot fifty miles to the N.N.W. of Quetta. The main shock occurred at 12h. 19m. G.M.T. on December 19, 1892. The distances from Strassburg and Nikolaiev are 5290 and 3480 km. respectively. The first waves from the disturbance reached Strassburg in 16 min. with a velocity of 5·51 km. per second, this being about the same velocity as that observed in the case of the Wjernoje earthquake of July 11, 1889. The first maxima took 18 mins. and 30 mins. respectively to traverse the distances. It is very evident that the wave motion at some distance from the epicentre is very complicated. For several hours before and after the earthquake earth tremors, were recorded by the instruments, the two kinds of disturbances appearing to proceed independently of each other.

Some interesting experiments with a rectangular glass prism are described by W. C. Röntgen in *Wiedemann's Annalen*. Those who have tried looking at themselves as reflected by two mirrors, placed at right angles to each other, will remember the amusing effect created by the image, contrary to the usual reflection in a mirror, not being reversed right and left. We can see ourselves "as others see us," also, by looking straight at the surface subtending the right angle of a rectangular prism. Herr Röntgen observes that in no case is the pupil divided into two equal parts by the faintly visible edge of the prism. This is an illustration of the angle between the line of vision and the axis of the eye, which is different in different people. Rectangular prisms can be easily tested for correctness of the angle by observing whether the two images of the cross-wires in a telescope, as seen in the two surfaces, coincide. The same test would tell us whether two mirrors are exactly at right angles—a fact which might be usefully applied for testing instruments like Gauss's heliotrope. Such a pair of mirrors, or a rectangular glass prism, give rise to another peculiar phenomenon. If they are rotated about the axis of vision, the image rotates in the same direction with twice the speed. If, therefore, the object, say a cardboard disc with writing on it, rotates twice as quickly as the mirrors or prism, it will appear to stand still. This might be applied to investigate the effects produced upon bodies by rapid rotation. Another peculiarity is that such an instrument will reflect rays falling upon the hypotenuse at any angle up to 45° to the same spot. By rotating such a prism about a line at right angles to its edge and to its hypotenuse the author was enabled to reflect the light from an electric lamp through a distance of 1 km. with ease and certainty.

In a communication to the *Electrician*, Prof. Fitzgerald criticises Herr Lenard's last paper, a short abstract of which appeared in Nature for May 31, 1894, p 114. In a former note on Herr Lenard's previous paper, Prof. Fitzgerald had pointed out that the experiments so far would be consistent with the supposition that the cathode rays were rays of light of very high frequency, except for the fact that they were deflected by magnetic force, a phenomenon of which we have no other evidence, and which makes it practically impossible at present to suppose that cathode rays are of this nature. It was further pointed out that if this deflection were an action on the emitting surface, and not on the ray, it might be again possible to explain these cathode rays by the supposition that they are rays of light. Herr Lenard's more recent experiments seem entirely at variance with any such supposition, while Prof. Fitzgerald considers that there is nothing in them that, in the same conclusive way, proves that they are not streams of electrified molecules or atoms. From Herr Lenard's observation that the deflection of the ray depends on the pressure of the gas in the tube in which the rays are generated originally, and not on the nature and pressure of the gas in the tube in which deflection takes place, it follows that, if the rays are paths of projectiles, they must either pass through the window, or else be projected from it, by some action which behaves like a blow given to it from the other side. A study of the spectrum of the cathode light might settle whether any of the molecules actually traversed the partition. The fact that there is no increase in the pressure within the tube only shows that as many molecules traverse the partition in one direction as in the other. Blows delivered on one side of a plate would project molecules from the other side, with different velocities depending on the nature of the blow and on the mass of the molecule, so that a hypothesis of this kind would be quite in accord with Herr Lenard's observations. The fact that the magnetic effect is independent of the mass of the molecule struck is explicable by supposing the electrical charge to be the same for all molecules. Even though sufficient reasons were forthcoming for rejecting the theory that these rays are due to projected molecules, Prof. Fitzgerald considers that there are other possible suggestions which are worthy of consideration, such that they are straight Grotthüs chains of molecules which bend under magnetic force. This might account for a velocity of propagation of actions along them, comparable with the velocity of light, without requiring the component matter to move with this velocity. In fact, until the residual matter within the tube has been reduced very much beyond what has been attained, and it has been shown that these phenomena increase instead of diminish, and that there is no very slow projection of the material of the plates, such as darkens the glass in glow-lamps, it will be very difficult to prove that any of the phenomena hitherto observed are due to the ether, and not to the matter present. So far the phenomena described are quite like those that would be due to moving electrified matter, and the actions are quite unlike anything we know of the properties of the ether.

The anomalies which are constantly observed in culture for bacteriological researches have, up to the present, been generally ascribed to abnormal conditions or to involution. Although the existence of polymorphism among bacteria may be inferred from the records of Metscknikoff, Weibel, Cornil and Babes, Kiessling, Karlinski, and especially those of Guignard and Charrin, as yet no absolute proof had been adduced to make it a fact. The *Weekblad v. h. Tydschrift v. Geneesk.* of April 28 contains an article in which the writers contend that among pleomorphic bacteria there are some species which, under different conditions, present different forms. Last year, when testing the water from the waterworks of Groningen, Ali Cohen and Uffelie, of the Hygienic Laboratory of that city, succeeded in cultivating in pepton Na Cl, fluid, spirilla which possessed all the morphological and biological properties generally ascribed to this species of organism. These spirilla, transplanted in nutritive gelatine, speedily developed colonies, but exclusively consisting of bacilli, These bacilli, replaced in a solution of pepton, Na Cl, reproduced again spirilla, not all identical, however, but consisting of commas, S forms, and short spirella. They repeated their experiments for several consecutive months, always with the same result. During these investigations another curious fact came under their notice. An organism which for several months, in alternate solid and fluid nutriment, had produced the alternate form of spirillum and bacillus, although the conditions of culture had not been altered in any way, lost at last the power of reproducing spirilla. The organism had retained all its individual characteristic properties, but it was impossible to revive this power. These observations led the writers to the conclusion that the present state of bacteriological science does not admit of ignoring the signs of polymorphy in bacteria, and that it is inaccurate to speak of normal and abnormal conditions, or to recommend as appropiate only those nutrients in which bacteria most speedily develop and accurately retain the form under which they are described in the text-books. The fact that most species of bacteria cultivated under glass gradually lose their power of multiplication, their loss of pathological and other biological properties, make this apparent. Even increased power of growth does not necessarily prove the exterior conditions to be favourable. It is well known that the bacillus of diphtheria loses its virulence in proportion as its power of development increases. In their opinion, therefore, it will henceforth be unsafe to deny, on morphological basis only, that the cholera spirillum may have developed from a certain form of bacillus, and that it is not invariably produced from an individual whom it morphologically resembles.

The first volume has been issued of Dr. Bowdler Sharpe's "Handbook to the Birds of Great Britain." The book belongs to the new edition of Allen's Naturalist's Library, of which Dr. Sharpe is the editor, and Messrs. W. H. Allen and Co. are the publishers.

We have received an excerpt from the Transactions of the Academy of Science of St. Louis (vol. vi. p. 481). Mr. Milton Updegraff is the author of the extracted paper, the subject of which is the determinations of the latitude, longitude, and height above sea-level of the Laws Observatory of the University of the State of Missouri, and the Observatory building and instruments.

The *Bulletin* of the Royal Gardens, Kew, Appendix ii. for 1894, is entirely occupied by a list of new garden plants brought into cultivation for the first time in the year 1893, including botanical varieties and hybrids, as well as the most noteworthy of those which have been reintroduced after being lost from cultivation, and others now for the first time described or published with authenticated names.

Part ii. No. 4, of vol. lxii. of the "Journal of the Asiatic Society of Bengal" contains two papers by Dr. G. King, the Superintendent of the Royal Botanic Garden, Calcutta: "On some Indian Species of *Canarium*," and a continuation of his "Materials for a Flora of the Malayan Peninsula"; also an account of the Deep Sea Collection made during the season of 1892-93 in H.M. Indian Marine Survey steamer *Investigator*, by Dr. A. Alcock, Superintendent of the Indian Museum.

We have received two important reprints from the "Sixth Annual Report of the Missouri Botanical Garden": North American species of *Sagittaria* and *Lophotocarpus*, by Jared G Smith, illustrated by twenty-nine beautifully executed plates; and a description, by W. Trelease, of *Leitneria Floridana*, a Floridan tree now for the first time discovered in south-eastern Missouri. The systematic position of this monotypic genus is still uncertain; the author being doubtful whether to place it near the Platanacea among Apetalæ, or near the Dipterocarpeæ or Balsamifluæ among Polypetalæ. This paper is also illustrated by fifteen excellent plates.

The first edition of Dr. J. E. V. Boas' "Lehrbuch der Zoologie für Studirende und Lehrer" (Gustav Fischer, Jena) was reviewed in these columns at the beginning of 1891 (vol. xliii. p. 268). A second edition of the manual has now been published. No alterations have been made in the plan of the book, but emendations and numerous additions have been inserted here and there, so as to bring the matter in line with recent work. Nearly fifty illustrations have also been added.

The tenth edition of "Quain's Elements of Anatomy" edited by Profs. E. A. Schäfer, F.R.S., and G. D. Thane, is slowly approaching completion. Messrs. Longmans, Green, and Co., the publishers of the work, have just issued the third part of vol. iii., dealing with the Organs of the Senses, and it is announced that the second part of this volume (Peripheral Nerves) will be published shortly. The fourth part (Visceral Anatomy) is in preparation, and will complete the work.

So long ago as 1883 we reviewed (vol. xxviii. p. 195) the first part of "Field and Garden Crops of the North-Western Provinces of Oudh," by Mr. J. F. Duthie, the Director of the Botanical Department of Northern India. The second part was published a year after the first, but the third and concluding part, dealing almost entirely with garden crops, has only just reached us. All important plants of this kind, grown in India on comparatively small plots, are described and excellently illustrated. Mr. Duthie has added to the usefulness of his work by giving at the end of the part just received a general index to all the parts.

In the Report of the U.S. National Museum for the fiscal year ending June 30, 1891, there are several papers describing and illustrating collections in the Museum, in addition to the reports of the various curators. Dr. G. Brown Goode describes the genesis of the Museum in an article full of information. The ethnological collections in the Museum from Kilima Njaro, East Africa, are enumerated by Dr. W. L. Abbott, and the Korean collections by Mr. Walter Hough, both papers being well illustrated. Mr. Romyn Hitchcock contributes three papers to the volume, one on Shinto, or the mythology of the Japanese, another on the ancient burial mounds of Japan, and a third on some ancient relics found in Japan. Finally, Mr. George H. Boehmer's exhaustive history of the prehistoric naval architecture of the North of Europe is included. This paper should be referred to by all who are interested in the development of the art of shipbuilding.

Scarcely a week passes without our receiving several voluminous reports on scientific work carried out under the auspices of the United States Government. One of the last volumes to come to hand is the Report of the U.S. Commissioner of Fish and Fisheries for 1889-91. The Commissioner's report alone is a valuable summary of work, but this covers less than one hundred pages, and the remaining 550 pages consist of papers upon various branches of inquiry. The subjects of these investigations are food-fishes and fishing-grounds, methods and statistics of the U.S. fisheries, the work of the U.S. Fish Commission steamer *Albatross*, the oyster resources and oyster fishery of the Pacific Coast of the United States, the coast fisheries of Texas, a review of the sparoid fishes of America and Europe, fish Entozoa from the Yellowstone National Park, and last, but not the least important, a translation of Prof. Haeckel's "Plankton-Studien," being "a comparative investigation of the importance and constitution of the marine fauna and flora." All these papers will be read with interest by students of marine biology.

SINCE 1844, Müller-Pouillet's "Lehrbuch der Physik und Meteorologie" (Vieweg und Sohn, Braunschweig) has passed through eight editions, and the ninth edition, edited by Dr. L. Pfanndler, only wants the second part of the second volume to complete it. There are three volumes altogether. Vol. i. treats of Mechanics and Acoustics, and vol. iii. of Magnetism and Electricity. The former appeared in 1886, and the latter in 1890. The publication of the second volume, dealing with Light and Heat, has been delayed owing to the removal of the editor to Graz University. Dr. Otto Lummer has, however, taken up the work where it was left, and the publishers have been able to issue the first part of the second volume, containing four chapters on Light. It is hoped that the remainder of the volume will be published at no very distant date. The whole edition has been thoroughly revised and greatly enlarged, the work, so far as yet published, running into more than 2200 pages. It is unfortunate that so many years should have elapsed between the publication of vols. i. and iii. and that the issue of vol. ii. should have been so long delayed. Owing to these differences of dates, the edition cannot be said to represent, as a whole, the state of physical science at any particular epoch. Like Jamin's and Ganot's and Deschanel's works on physics, that of Müller-Pouillet is amply illustrated. All experimental apparatus is fully described, and the objects accomplished with it explained in detail without the use of advanced mathematics. In a prefatory announcement the work is commended to those "welche nicht Gelegenheit finden, akademische Vorträge mit Experimenten zu besuchen." From this one could be led to believe that the manual was suitable for reading by a public debarred from seeing physical experiments performed. This, however, is not the case. The place of the work is among books of reference suitable for elementary students of natural philosophy, not with those designed for general readers.

THE additions to the Zoological Society's Gardens during the past week include a Bornean Ape (*Macacus inornatus*, ♀) from Borneo, presented by Mrs. Florence Firman; a Puma (*Felis concolor*, ♀) from South America, presented by Miss Florence Dickinson; a Leopard (*Felis pardus*, ♂), a Cheetah (*Cynælurus jubatus*) from East Africa, presented by Major Owen; an Isabelline Bear (*Ursus isabellinus*, ♂) from Cashmere, presented by Mr. E. Haag; a Sloth Bear (*Melursus ursinus*) from the Hills of Orrissa, Bengal, presented by Mr. J. W. Currie; a Downy Owl (*Pulsatrix torquatus*) from Brazil, presented by Dr. E. A. Goeldi; an Eroded Cinixys (*Cinixys erosa*) from Cape Lopez, Gaboon, presented by Commander J. L. Marx, R.N.; a Greek Tortoise (*Testudo græca*) from Greece, presented by Mr. H. K. Bartlett; a Hoolock Gibbon (*Hylobates hoolock*) from Assam, a Black-handed Teetee (*Callithrix melanochir*) from Brazil, a Black-winged Peafowl (♂) from Cochin China, five Heloderms (*Heloderma suspectum*) from Arizona, deposited; a Great Anteater (*Myrmecophaga jubata*) from South America, a Black Stork (*Ciconia nigra*), European, two Japanese Teal (*Querquedula formosa*) from North-East Asia, purchased; a Wapiti Deer (*Cervus Canadensis*, ♂), a Mouflon (*Ovis musimon*, ♀), a Yellow-footed Rock Kangaroo (*Petrogale xanthopus*, ♂), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

BRIGHT-LINE STARS.—Exact information about stars with bright lines in their spectra is appreciated by all who have the advance of celestial science at heart. In a paper in the June number of *Astronomy and Astro-Physics*, Prof. W. W. Campbell brings together all that is known with regard to objects of this spectroscopic character, and adds to the literature a number of important observations made by himself. Since 1867, when MM. Wolf and Rayet discovered three bright-line stars in Cygnus, fifty-two objects of the same type have been found, forty-two of this number being placed to the credit of the Harvard College Observatory. Prof. Campbell has made visual determinations of the positions of the lines in the spectra of thirty-two of these stars, and has also photographed the spectra in juxtaposition with a hydrogen comparison spectrum. One of the most noteworthy facts brought out by the observations is that the hydrogen lines in the spectra present a variety of forms and intensities. In many of the stars they are dark; in others, they are dark with bright borders. The bright hydrogen lines vary from faint to very bright, from monochromatic lines to very broad bands, and from those clearly single to those apparently multiple. Like many lines in the spectra of nebulæ, those of bright-line stars are difficult to identify with terrestial substances. The ubiquitous lines of hydrogen are certainly present, and Prof. Campbell finds that prominent lines of iron and other elements appear to coincide with a few of the star lines, while a line at wave-length 4480 suggests to him a magnesium origin, but the identifications are not sufficient to lead him to make any definite conclusions. Much more can be learnt from his comparison, in tabular form, of lines in stars of the Wolf-Rayet type with those found in the solar chromosphere, in Nova Aurigæ, and nebulæ; also with dark lines in Orion stars, and in β Lyræ. The hydrogen lines are shown to be prominent in all the six spectra. With the exception of the lines of hydrogen, D_3, and that at λ 4472, lines in the chromosphere do not furnish any striking coincidences with lines in Wolf-Rayet stars. The parallel columns of lines also fail to indicate any connection between these stars and Novæ, the only point of similarity being that the lines in both these classes of celestial objects are broad. As is well known, the nebular spectrum and that of bright-line stars are much alike. A close examination, however, has led Prof. Campbell to think that nine prominent star-lines do not occur in nebulæ; while, on the other hand, five nebular lines were unsuccessfully looked for in the stars. His deductions from the whole of the observations are summed up as follows:—"In conclusion, I think we can say that the spectra of the Wolf Rayet stars are not closely related to any other known type. They appear to have several points in common with the nebular and Orion type spectra; but the last two appear to be much more closely related to each other than to the Wolf-Rayet spectra. It is therefore difficult to place these stars between the nebulæ and Orion stars. They certainly do not come *after* the Orion stars, and one does not like to place them *before* the nebulæ. We can probably say that the bright lines are chromospheric, owing their origin to very extensive and highly heated atmospheres, but showing very little relation, in constitution and physical condition, to that of our own sun. For the present, at least, this type of spectrum must be considered as distinct from every other known type, just as the nebular spectrum is distinct, and like the nebular spectrum containing lines whose origin cannot now be assigned."

EPHEMERIS FOR GALE'S COMET.—The following positions for Gale's comet are from the ephemeris given by Prof. Kreutz in *Astronomische Nachrichten*, No. 3229:—

Ephemeris for Berlin Midnight.

1894.	R.A. h. m. s.	Decl. ° ′	Brightness.
June 23	11 54 33	N. 43 1·4	0·14
27	12 2 16	43 15·9	0·12
July 1	12 9 47	43 25·5	0·10
5	12 17 7	43 31·0	0·09
9	12 24 19	43 33·5	0·07
13	12 31 26	43 33·1	0·06